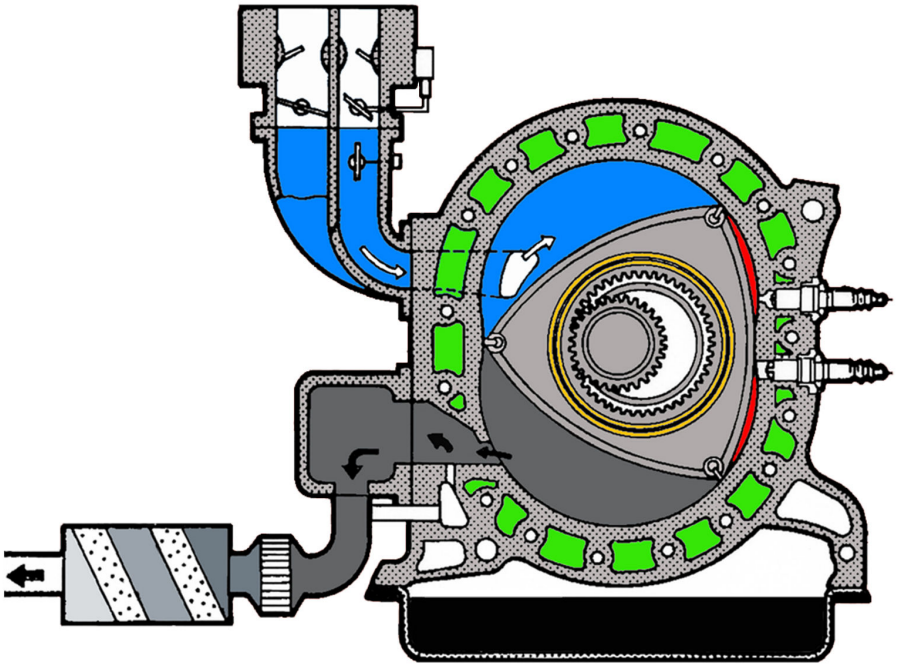
# *User Manual*

***Model ReCT-04***

## *The Rotary-engine Compression Tester*

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# *Using the Rotary-engine Compression Tester System*

## *Introduction*

The Rotary-engine Compression Tester can be used to obtain accurate engine compression measurements in a rotary (i.e., Wankel) engine. The Tester combines the output from an AST pressure transducer with the data conversion function of a DATAQ analog-to-digital device to acquire and record accurate compression readings for each face of each rotor in a rotary engine. This system also allows the calculation of engine cranking RPM during the test for data normalization.

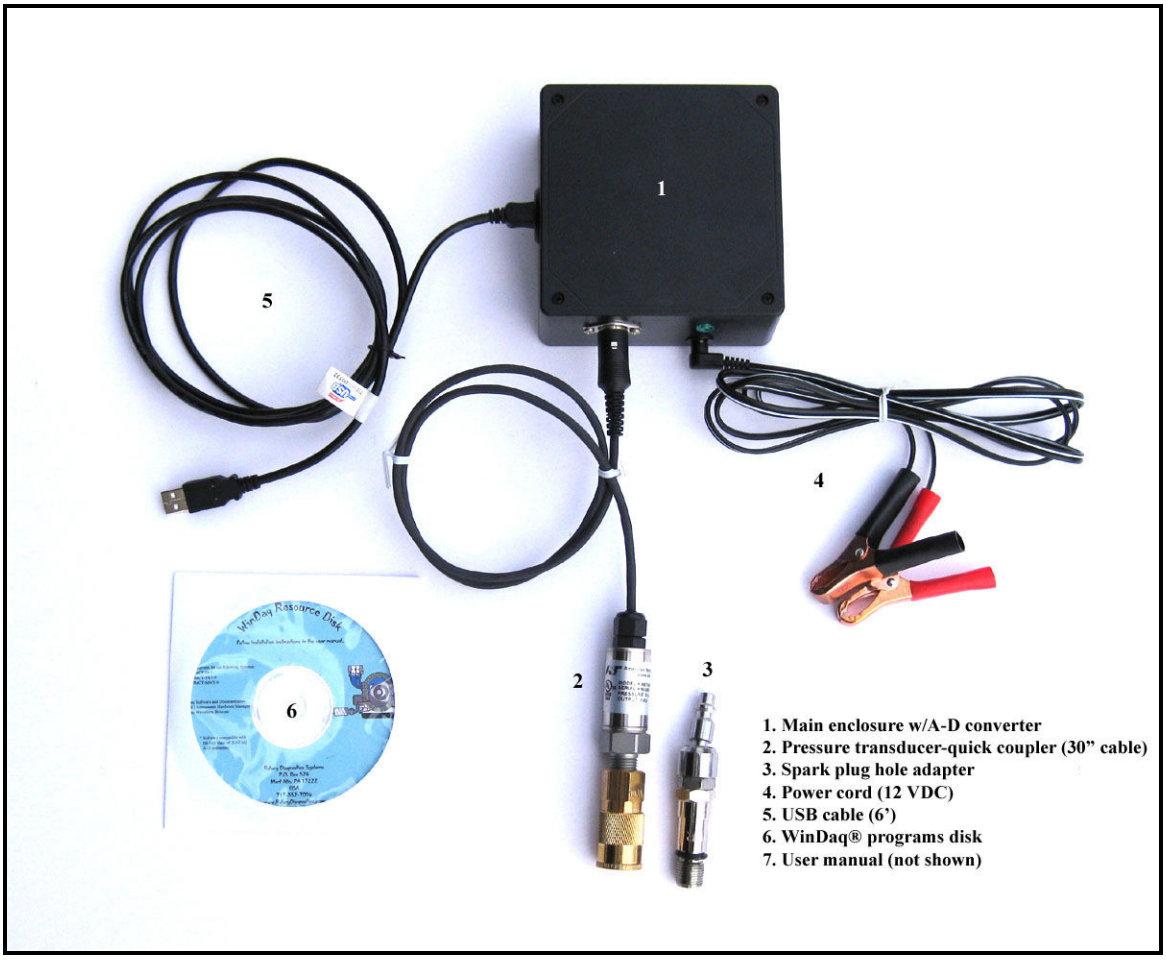


***Figure 1. Rotary-engine Compression Tester system Model ReCT-04 components***[1].

This system is useful in helping to diagnose suspected engine-related issues, to monitor engine health over time and to demonstrate engine health in real-time.

[1] A windows computer, preferably a notebook/laptop, with an available USB port is required for use with this system. **A computer is not included with the tester**. For connecting the tester to a remotely-located computer, a USB extension cable up to 10 feet in length can be used with the supplied cable. USB extension cables are available from a number of sources including RDS (http://rotarydiagnostics.com). Do not exceed 16 feet total length of any USB cable or cable-extension combination.

It should be clearly understood that this system requires installation and configuration of software and manual extraction of the compression readings and engine cranking RPM from the recorded data. The readings are not automatically presented to the user, as is the case with much more expensive, rotary-engine compression testers. Users with basic computer skills should have no problem installing and operating this system.

This user manual contains all the information you will need to install and configure the associated software and to operate the system to conduct a compression test on your rotary engine. However, should you wish to know more about the DATAQ data conversion hardware or the WinDaq® software, manuals for both are installed on your computer with the programs and are available via the WINDAQ® program group under the Programs menu. (WinDaq® is a registered trademark of DATAQ Instruments, Inc.) You can also go to the DATAQ web site for more information. Links to that site, as well as to the AST web site, are in the *References* section of this manual. All support for the Tester is provided by RDS. The user should not contact the component manufacturers directly for support. (See the Warranty section for instructions on how to obtain support for this system.)

## *Installing the DATAQ software*[2]

The software installation and configuration[3] task involves the following steps:

1. Installation of the hardware drivers and the WinDaq® programs associated with the DI-145 data converter unit.
2. Configuration of the DATAQ Instruments Hardware Manager.

The main programs associated with the DI-145 data converter are the DATAQ Instruments Hardware Manager (hereinafter referred to as the Hardware Manager) and the WinDaq® Waveform Browser. The Hardware Manager is used to record the compression data during the test, and the WinDaq® Waveform Browser is used to view, extract and analyze the compression readings. The hardware drivers and both programs are provided on The WinDaq® Resource Disk and must be installed on your computer.

If you have basic computer skills, you can probably work through the install process with little or no assistance. [Otherwise, refer to *Appendix A* for step-by-step instructions.] Do not connect the main enclosure to your computer at this time. During the install process, you will be instructed when to connect the main enclosure. To begin software installation, insert the WinDaq® Resource Disk into your CD/DVD drive. The install program should start automatically. If it does not, navigate to your CD/DVD drive and double-click on the *exe* file. Follow the instructions on each succeeding install window.

When asked if you want to install WinDaq/XL, select “No Thanks”. WinDaq/XL is an add-on program which requires an additional purchase and it is not required for this application. The installation of hardware drivers and programs is a one-time exercise. If you have successfully completed the driver and software installation, you can proceed with configuring the Hardware Manager.

[2] These instructions apply specifically to the DATAQ DI-145, the associated WinDaq® Lite program, and AST4000 pressure transducer (0-200 PSI, 10-28VDC input, 1-5VDC output).

[3] This task does not require access to a vehicle. It can be completed anywhere as long as the system enclosure is connected to: the computer using the supplied USB cable, to a 12 VDC power source, and to the pressure transducer.

## *Hardware Manager Configuration*[4]

To begin the Hardware Manager configuration, connect the main enclosure to the computer using the USB cable provided. Then connect the pressure transducer-quick coupler to the enclosure and connect the power cord to the enclosure and to any 12VDC power source—usually the car battery. If you installed the DI-145 drivers successfully, the operating system will automatically activate the drivers for the DI-145 when the cable is plugged into the USB port. Launch the Hardware Manager program from the Start>Programs>WinDaq® program group menu. When the devices list appears, highlight the DI-145 device and press the Start WinDaq® button. Continue with the following settings.

Edit>Channels

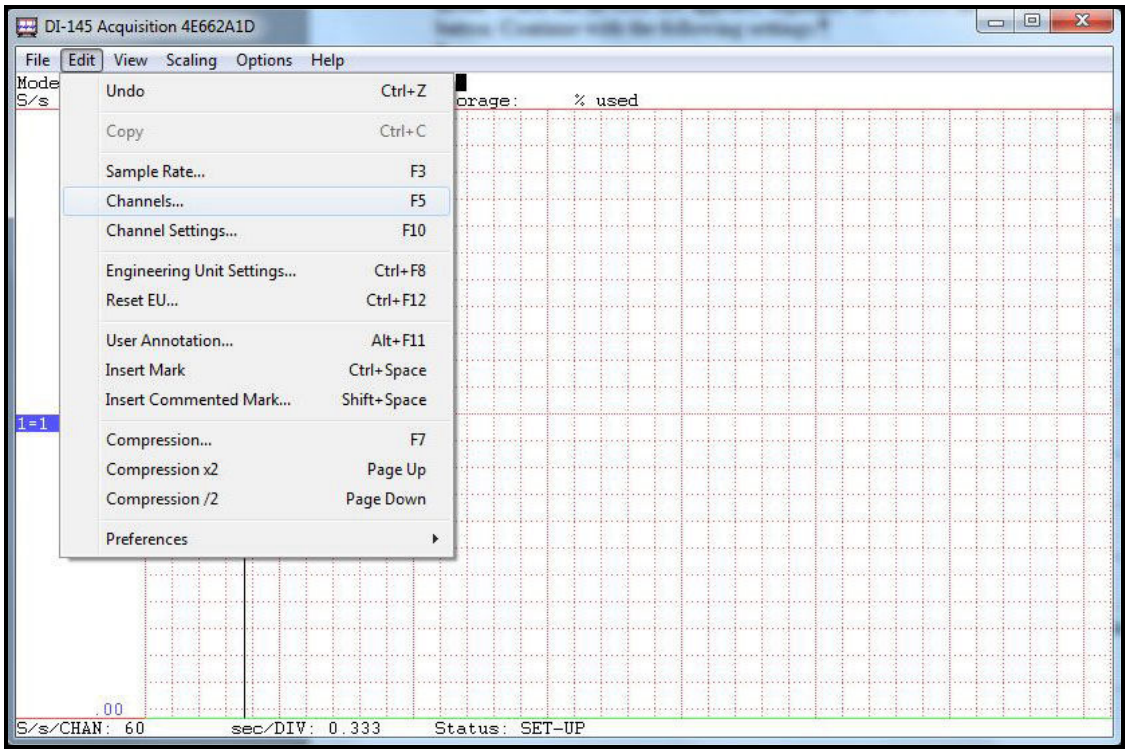


***Figure 2. Hardware Manager channel selection.***

[4] All settings in the Hardware Manager are specific to the System hardware and are usually retained for future tests. (See note on page 10 for more information.)

At the blinking cursor, type “-4” and press enter. Type “-3” and press enter. Type “-2” and press enter. (You may have to use the minus and number keys at the top of the keyboard rather than the keypad.)

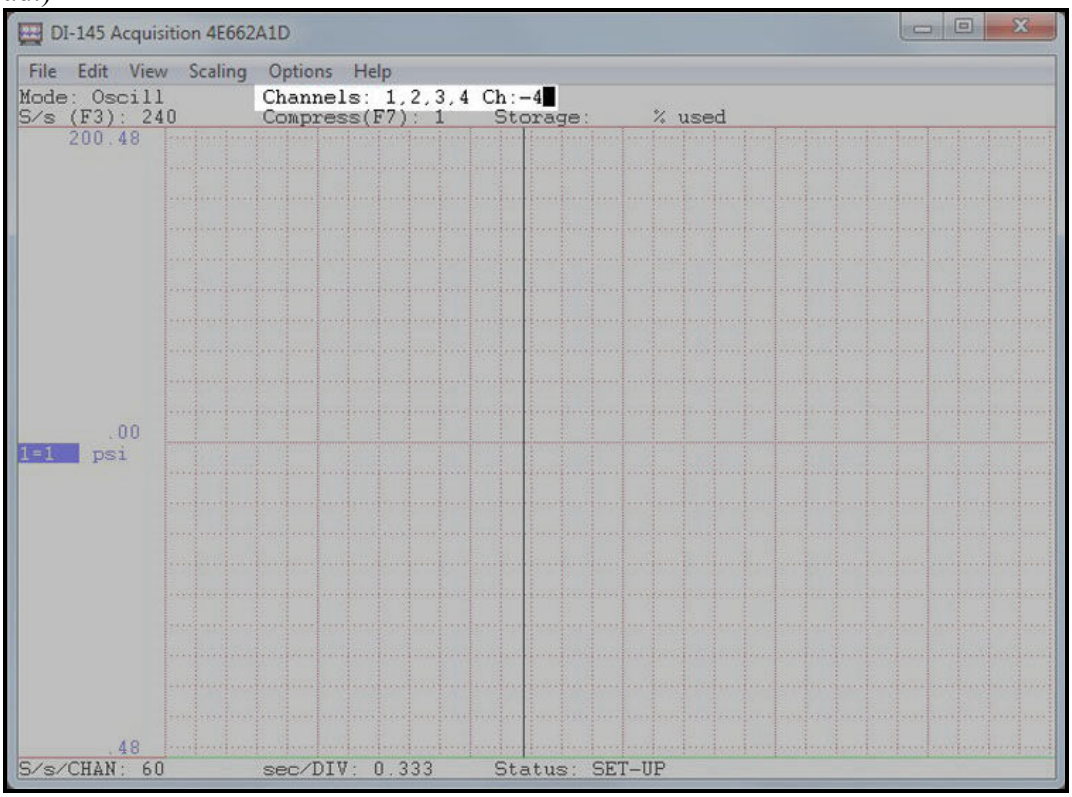


***Figure 3. Selecting only 1 channel to record.***

Verify that only the number 1 is shown adjacent to Channels.

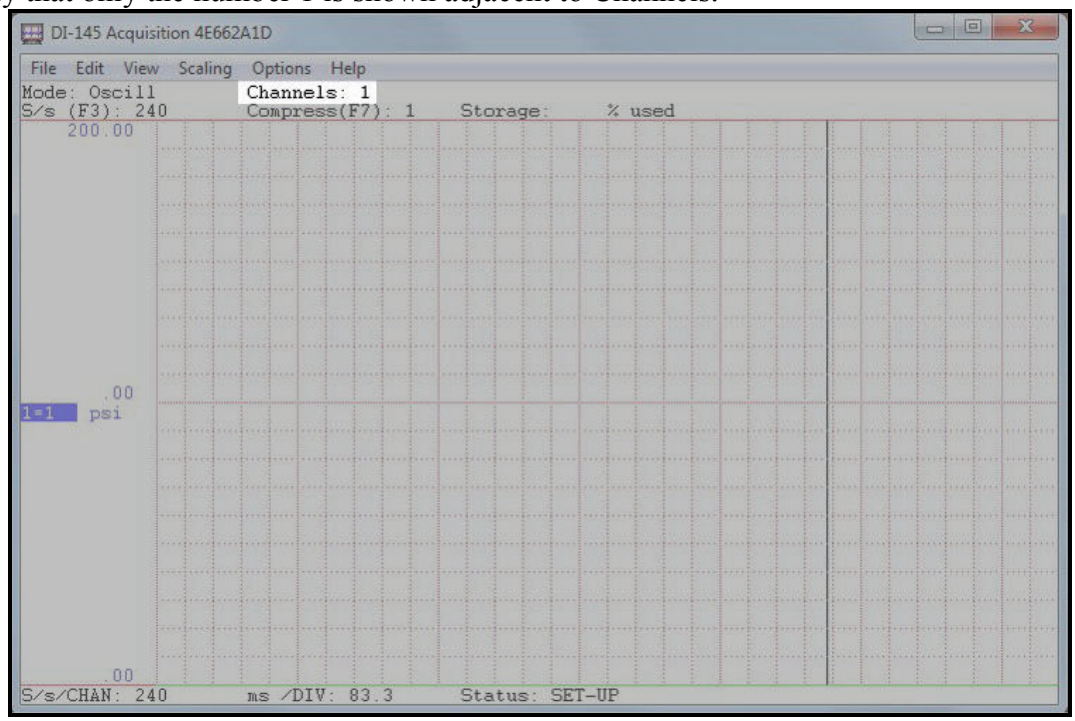


***Figure 4. One channel selected.***

NOTE: It is important that only one channel is shown since the maximum total throughput sampling rate of 240 samples/second (S/s) is divided by the number of channels activated. For example, if 4 channels are activated, the sample rate for your one channel test will be reduced to 60 S/s, resulting in a very notchy-looking trace. Accuracy will not be significantly affected, but the data display will appear to be very crude.

View>Format Screen

Select 1 Waveform

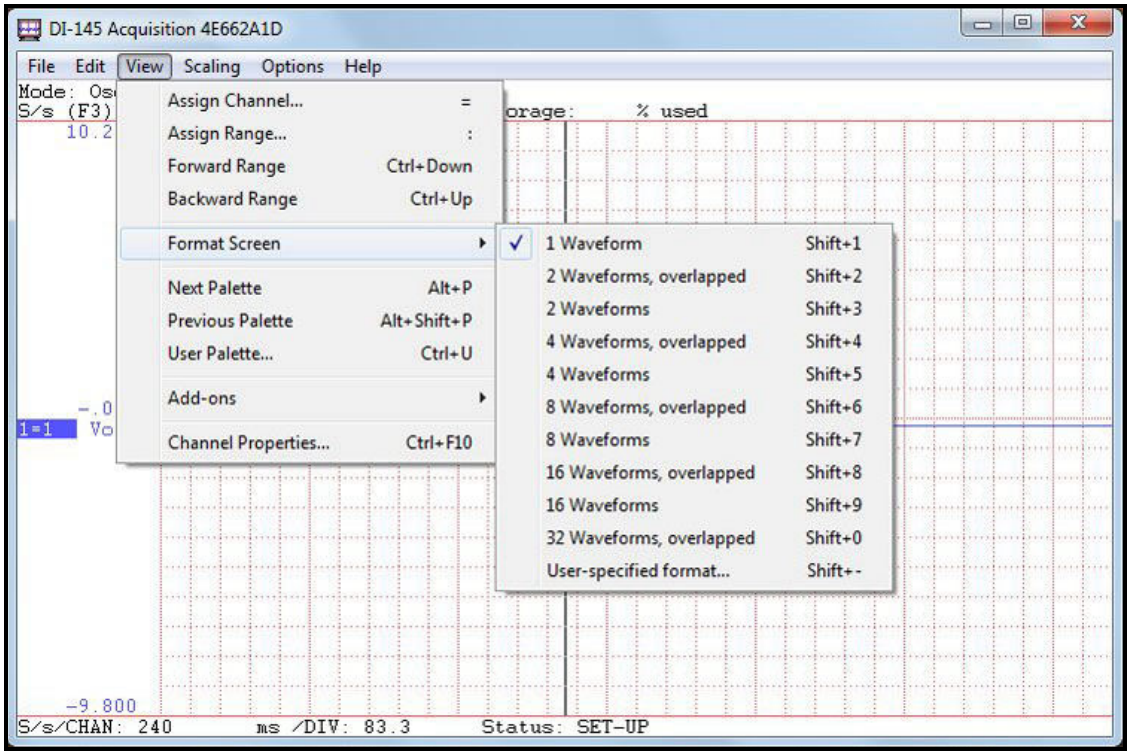


***Figure 5. Hardware Manager screen display setting***

Edit>Engineering Unit Settings:

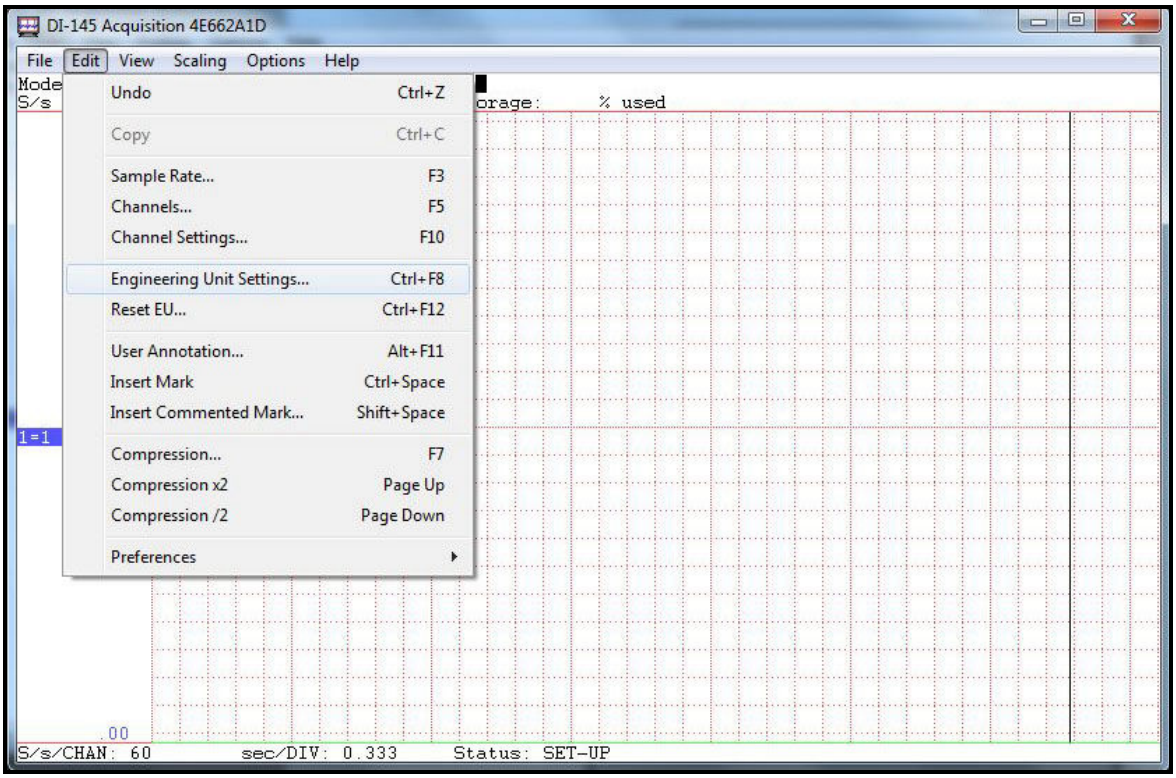


*Figure 6. Hardware Manager Engineering Unit Settings.*

Upper Level Volts=5 volts
Upper Level EU=200
Lower Level Volts=1
Lower Level EU=0
EU Tag=PSI
Click OK.

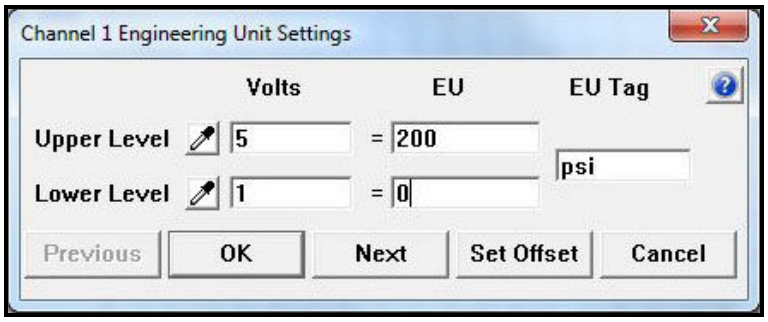


*Figure 7. Hardware Manager Engineering Unit Settings.*

Edit>Engineering Unit Settings (yes again).

Verify settings.

Click on Set Offset.

Enter 0 in the Desired Reading box.

Click OK, then OK again to complete this setting.

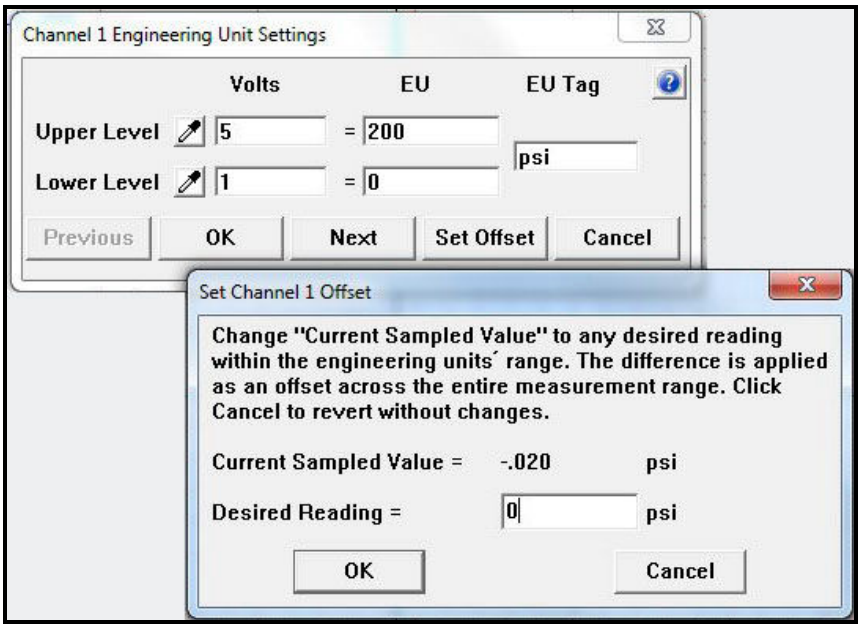


***Figure 8. Hardware Manager Engineering Unit Settings, Set Offset.***

Scaling>Limits:

Top Limit=200

Bottom Limit=0 (may show as .00)

Click OK

***Figure 9. Hardware Manager scaling limit setting.***

Edit>Sample Rate:

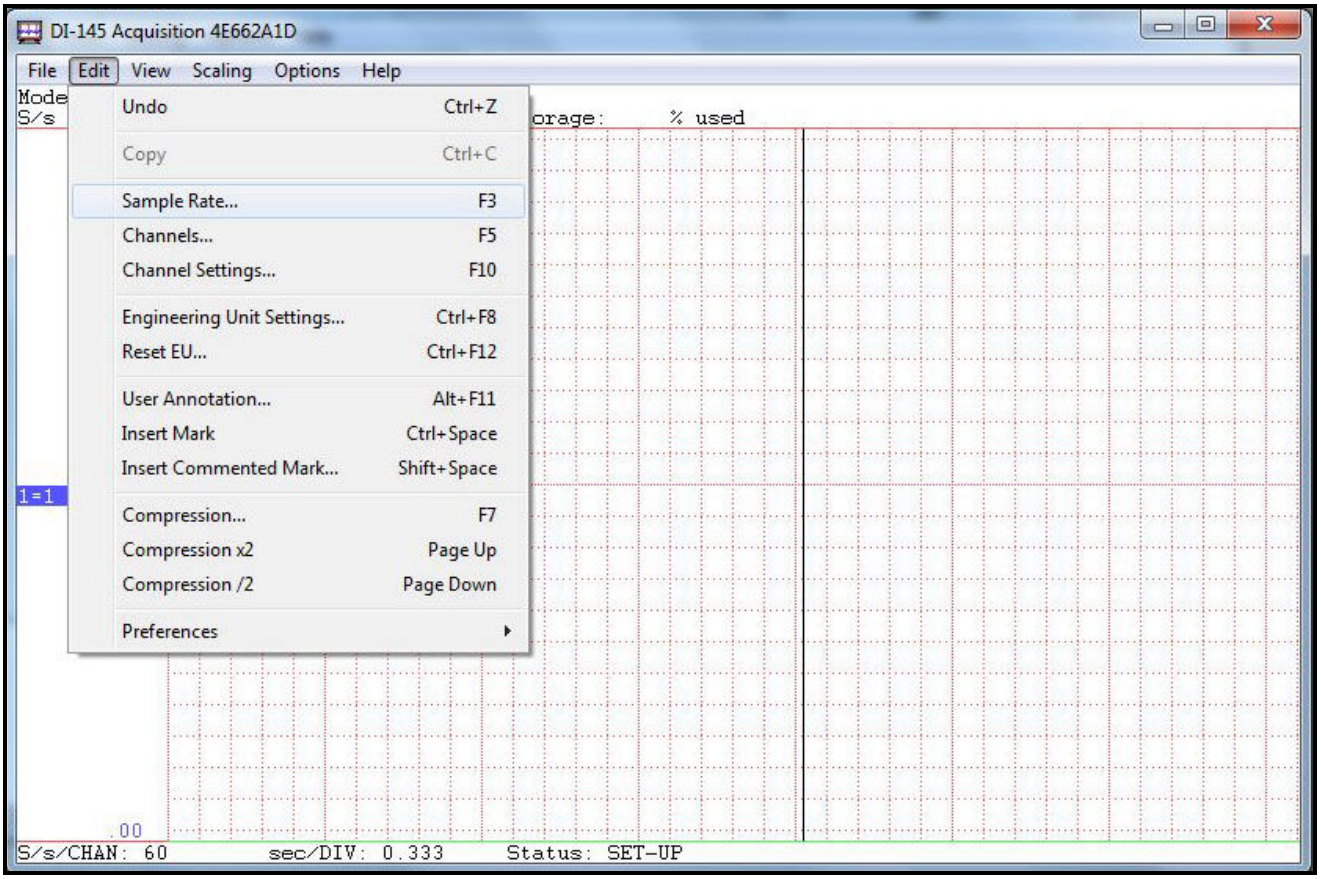


***Figure 10. Sample rate selection.***

Make sure that the Sample Rate is set at 240[5]. If it is not, type in 240.

***Figure 11. Sample rate setting.***

[5] The default maximum total throughput sample rate for the WinDaq®/Lite program supplied with this system is 240 samples/second. Use the default rate for the most pleasing data display.

Verify that the per-channel S/s rate setting in the lower left of the display.

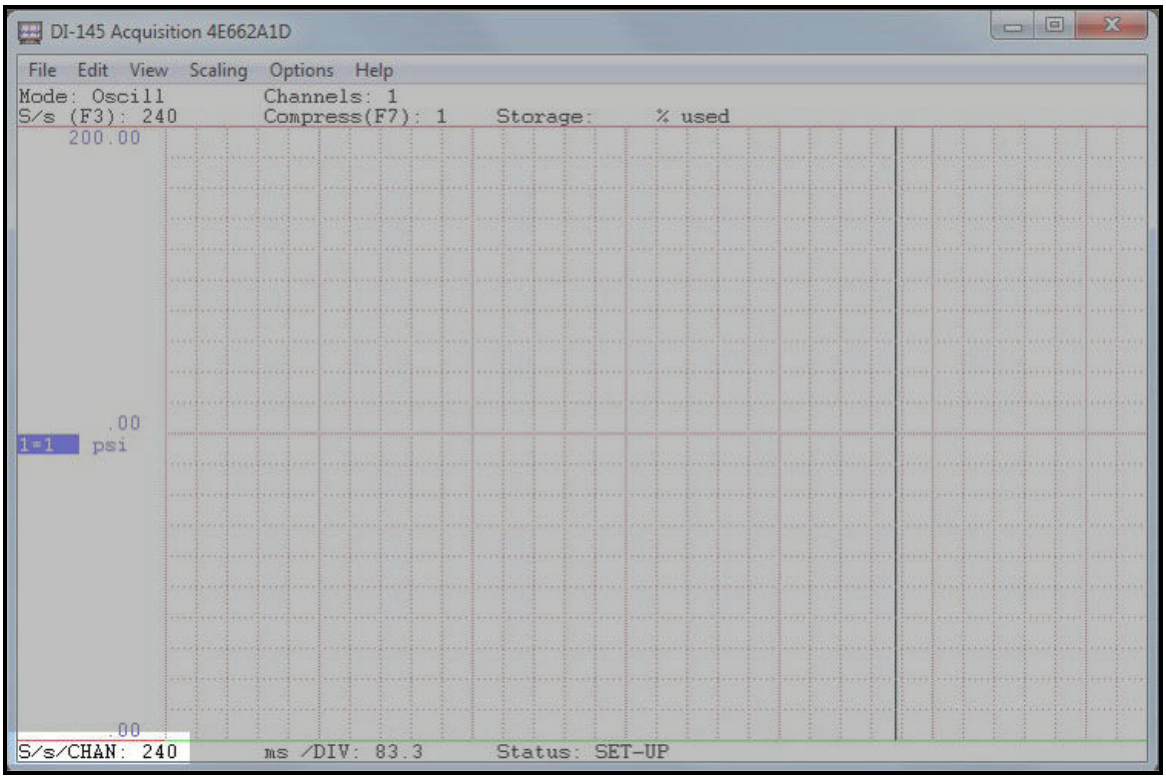


***Figure 12. Sample rate set at 240 S/s.***

Do *File>Save default setup* and you have completed configuration of the Hardware Manager (see Note below). You are now ready to conduct compression tests. To conduct a test, follow the instructions on the next few pages.

[*Note: The settings just configured are associated only with the specific DATAQ unit installed in the enclosure. Each System has a unique serial number that is the same as the DATAQ unit serial number. Note that the unit/System serial number is listed along with the DATAQ unit description in the main hardware windows.*
*The configuration settings completed above will normally be retained in your computer for future use. However, if you are not planning to conduct a test now, we strongly advise that you run through the configuration procedure again as part of your preparation to conduct a test when all tester components are connected and powered up*.]

## *Conducting the compression test*

***Preparing the vehicle and recording program:***

1. Warm up the engine. If using the car battery as the power source, it should be fully charged.
2. Remove one of the spark plugs—either leading or trailing—in one of the rotor housings. Do not remove any other spark plugs.
3. Disable engine ignition and fuel delivery systems. If you are not sure how to do this, consult a workshop manual for your particular vehicle to determine the best method for disabling these systems. For most modern fuel-injected rotary engines, that can be accomplished by removing the EGI fuse(s) from the engine-compartment fuse box. However, in the case of the RX-8, Mazda recommends disconnecting the Eccentric Shaft Position Sensor located at the lower, front left of the engine to disable these systems.
4. Screw the spark plug hole adapter into the plug hole. **Make sure the adapter is screwed in finger-tight, but snugly and that the O-ring is sealing**. **Do not over tighten.** You can use a little silicone-based grease, like dielectric grease for example, to lubricate the O-ring and facilitate sealing. But DO NOT use a petroleum-based oil or grease on the O-rings.
5. Connect the pressure transducer-quick coupler to the adapter and to the enclosure using the attached cable and DIN connector. *[**NOTICE:** The pressure transducer used in this system is a precision instrument and should be handled accordingly. While the unit is not fragile, **extreme** mishandling, especially involving high, lateral G forces, may damage the internal sensor elements in the pressure transducer, rendering it inoperable.]*
6. Plug the power cord into the connector on the side of the enclosure and connect the battery clips to the appropriate battery terminals (Red=Pos; Black=Neg), or another 12VDC power source. [Be very careful when making this connection. Connect red clip to positive battery post, then black clip to negative battery post. Remove in reverse order when the test is completed.]
7. Verify that the green LED power indicator is lit. If it is not, see the *Troubleshooting* section.
8. Boot up your computer fully and connect the USB cable to the Tester enclosure and to the computer.
9. Launch the Hardware Manager program from the Start>Programs>WINDAQ® program group. Select the DI-145 when it appears in the list and click *Start WinDaq®*.

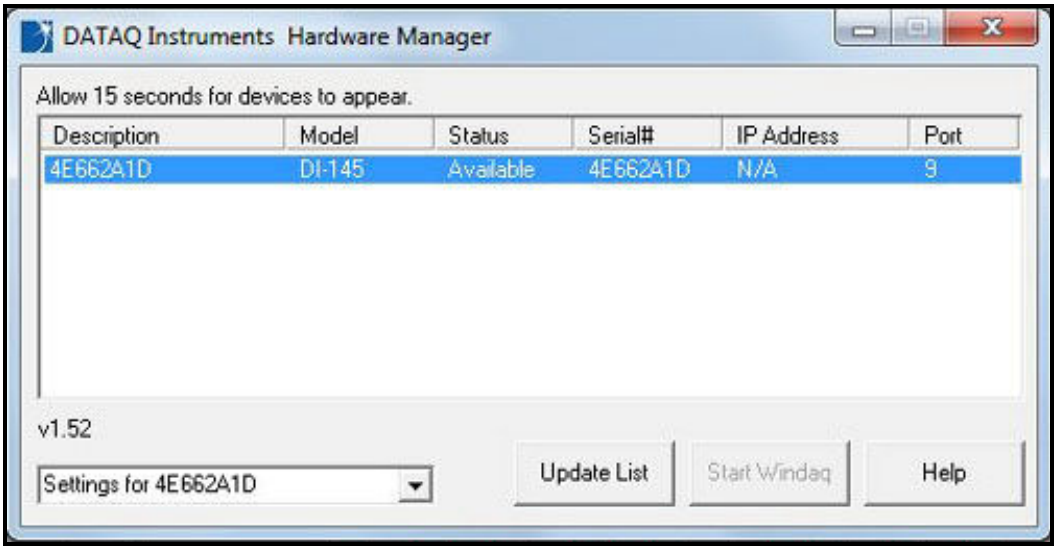


***Figure 13. Hardware Manager hardware listing of DI-145.***

10. Verify that the Scaling>Limits upper and lower limits are 200 and 0 (or .00) respectively. If they are not, you will need to run through the Hardware Manager configuration again before proceeding.

11. Select File>Record from the Hardware Manager menu to start data recording. Select a folder for storing the data file and name the file something meaningful, like the car year and model and the date, then click Open.

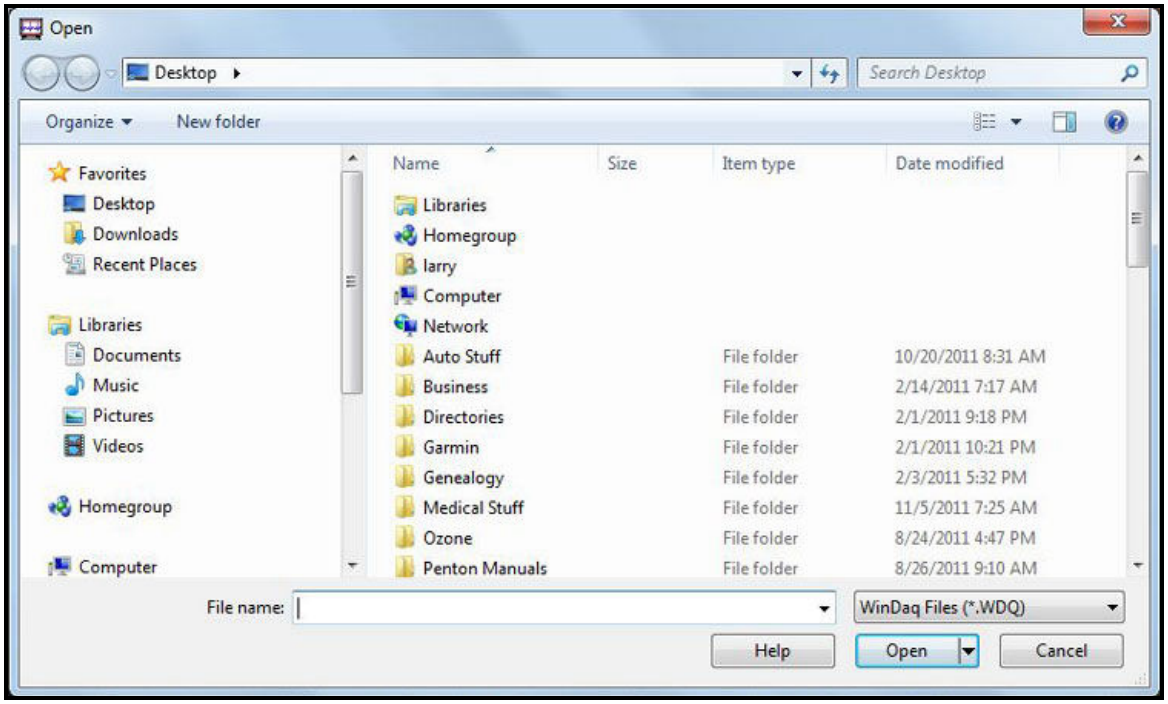


***Figure 14. Hardware Manager Record file name selection.***

12. Select the recording time/file size desired and when you are ready**, and only when ready, to conduct the test and to start the recording**, click OK**.**[6] Continue with "Conducting the test" section that follows when ready.

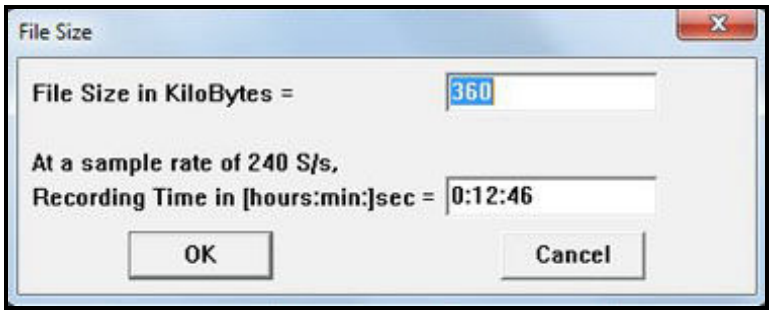


***Figure 15. Hardware Manager recording time and file size selection.***

[6] To pause the recording at any time during the test, do File>Stop. To resume recording do File>Record. To completely stop recording, do File>Close or File>Exit.

***Conducting the test:***

Now that your car has been prepared for the test, all the data and power connections have been made, and the Hardware Manager program has been set up and ready to record, you are ready to conduct the test.

1. Check all your connections before proceeding and make sure the ignition and fuel delivery systems have been disabled. *(Note: Make sure all connections are well clear of engine rotating parts.)*
2. Start the recording function in Hardware Manager (Click OK as instructed in item 12. above.)
3. Get in the car, **depress the gas pedal to the floor** (important) and activate the starter for about 5 seconds.[7]
4. Put the software on standby (File>Stop).[8]
5. Remove the spark plug hole adapter from the first rotor plug hole, and reinstall the spark plug. Remove a spark plug from the other rotor housing, screw in the adapter and attach the pressure transducer-quick coupler.
6. Resume the Record function in the Hardware Manager program (File>Record).
7. Get in the car, **depress the gas pedal to the floor** and activate the starter for about 5 seconds.
8. Stop recording (File>Stop). The test is completed so you can save the recording (File>Exit). Exit the Hardware Manager program, disconnect all cables and remove the adapter.[9] If the Hardware Manager device selection window is still open, close it.
9. Reinstall the spark plug, reconnect the spark plug wires and enable the ignition and fuel delivery systems. You have completed the data acquisition part of the test.

The recorded data can now be viewed and analyzed using the WinDaq® WaveForm Browser as described in the following sections.

## *Extracting and interpreting the data*

Launch the WinDaq® Waveform Browser from the Start>Programs>WinDaq® program group and open the ".wdq" file created during the test. Using the slider at the bottom of the window, scan for and locate the recorded compression pulses. [A helpful hint is in order at this point. The total record time for the test is likely to be several minutes long, and a 5-second burst of compression pulses, therefore, may be difficult to locate or keep track of in the data record. Before concluding that no data was recorded, scan the entire record for the compression pulses. It actually may be there somewhere, essentially hiding in the long data record.]

A cursory examination of the recorded data will quickly reveal any significant problems with engine compression. The absence of pulse peaks where expected or very low compression readings are indications of rotor seal failure and one need go no further with data extraction and analysis. The engine will likely require rebuilding or replacement. However, additional compression tests should be conducted to verify any questionable numbers. (See the section *Meaning of the compression readings* for additional information.)

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[7] You may choose to have someone else do this part while you monitor the tester, connections and computer.

[8] This is optional, but your data record will be much longer if you don't pause the recording when switching plug holes and you may have difficulty keeping track of the compression pulse locations in the record.

[9] Disconnecting tester hardware from the computer before closing the programs may cause your computer to freeze requiring a reboot.

Significant differences between the peak pulse amplitudes is also an indication of failing rotor seals, and depending on the extent of the difference, this may also be an indication the need to rebuild or replace an engine. In this case, continue with data extraction and analysis to determine the relative health of the engine. Proceed with the following instructions to extract the recorded values and to normalize the data for comparison to the vehicle manufacturers specifications. Only then can the recorded readings be used to determine the exact status of engine health.

Referring to the sample record in Figure 16, note that the compression pulses are represented by the peaks in the recording, each peak representing a compression pulse of a single rotor face. The compression of each rotor face is repeated every third pulse. The maximum compression of each face is represented by the peak value at that point in the test. Peak compression readings for each rotor face are viewed by moving the line cursor in the display to the peak of each pulse and noting the compression number displayed at the left side of the window (119.44 PSI in the sample).

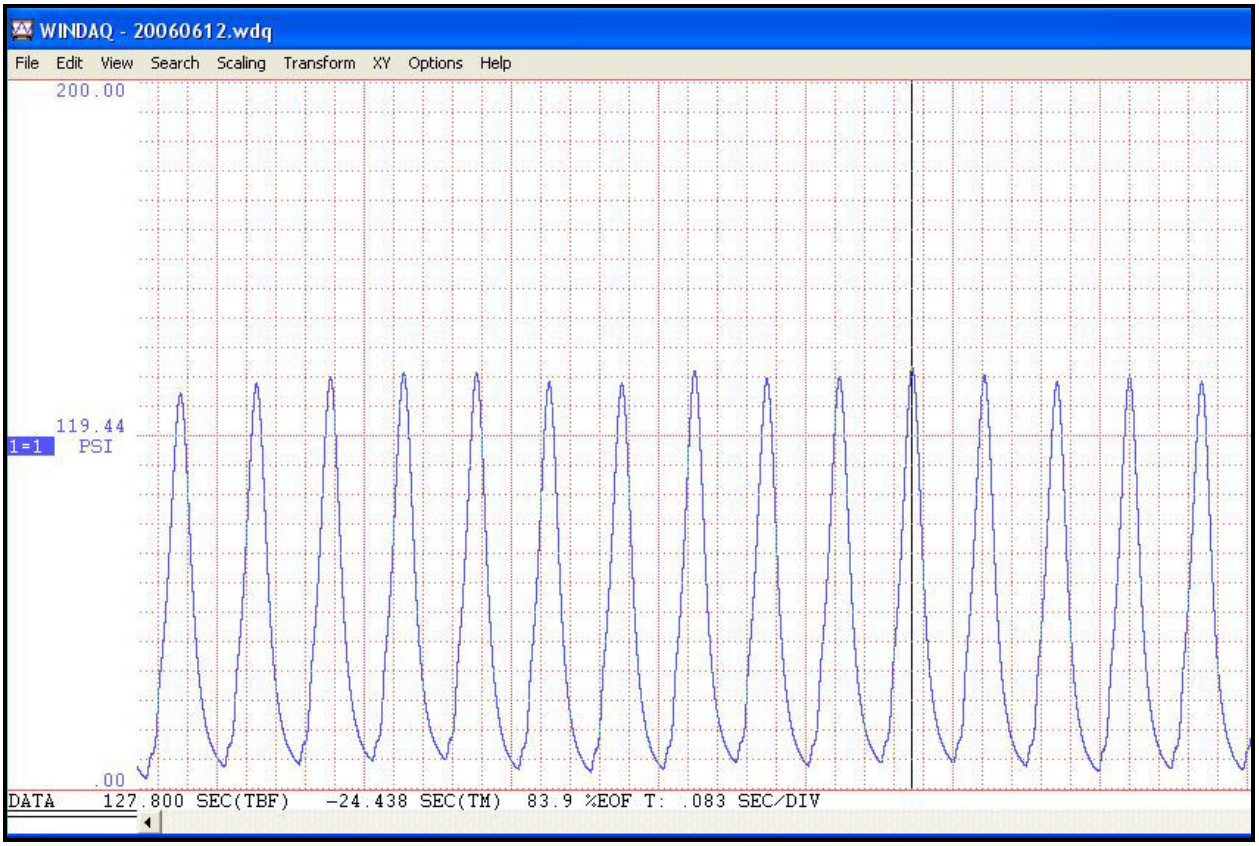


***Figure 16. Sample recorded compression readings for a single rotor.***

To move the line cursor, place the mouse cursor on the "DATA" bar at the bottom of the display directly below the line cursor, hold down the left mouse button and drag the line cursor to the desired position in the display. Move the line cursor left and right slightly until the maximum reading for the peak of interest is shown at the left. After you have read and made note of a meaningful series of peak pulses, you can easily calculate the differences between the compression readings of rotor faces and between rotors in order to compare the readings with the engine manufacturers specification.

To spread out the peaks for a clearer display of the data, select *Edit>Compression* from the menu and type in a negative number like –2 in the *Compression* box. Higher negative numbers will spread out the display even further. [The term compression as used here refers to data display compression, not engine compression.]

However, if the engine cranking speed at the time of the test was significantly higher or lower than 250 RPM you should normalize the readings in order to compare them to the Mazda[10] engine specifications.

***Normalizing the recorded data***

Mazda specifications for engine compression are generally specified with an engine cranking speed of 250 RPM. If your engine cranking speed (see below for how to calculate engine cranking speed) during the test is close to 250 RPM, you can use the readings as recorded. However, if engine-cranking speed deviates significantly from the Mazda criteria, you may want to proceed with normalization of the recorded readings. Essentially, slower engine cranking RPM during the test will result in readings lower than the Mazda "standard". Mazda workshop manuals provide simple graphs that can be used for this purpose.

Be aware that our systems do not compensate for differences in atmospheric pressure due to elevation or weather conditions. Mazda shop manuals for some models include a graph for elevation/altitude correction. Comparable graphs are available on various web sites including Wikipedia.com.

The following instructions provide procedures for calculating engine cranking RPM from the recorded data to convert the readings for comparison to the Mazda specification.

***Engine RPM calculation.*** As stated above, to normalize the measured compression readings, the engine cranking RPM at the time of the test must be determined. Using the WinDaq® Waveform Browser, the engine cranking RPM during the test can be determined by measuring elapsed time between a number of compression peaks and converting that to the equivalent revolutions of the eccentric shaft per minute. [Note: For the highest accuracy, use a series of compression peaks near the middle of recorded data to eliminate any start-up lag at the beginning of the test and possible minor battery voltage drop-off near the end of the test.]

Using the example in Figure 17 for reference, calculate the engine RPM as follows: First, place your cursor in the "DATA" bar at the bottom of the display directly below the line cursor on the screen. Holding the left mouse button down, move the cursor to one of the compression peaks and record the time displayed at the lower left corner of the window.

In the example, the elapsed time at peak #0 is 127.19 (rounded from 127.188) seconds. Move the line cursor 9 peaks further along the data record (i.e., peak #9), recording the time—129.03. Subtracting 127.19 from 129.03 gives an elapsed time of 1.84 seconds. Since this span of pulses equates to 9 compression cycles or 9 eccentric shaft revolutions (i.e., 3 eccentric shaft revolution per rotor revolution x 3), the elapsed time of 1.84 seconds equates to the elapsed time for 9 eccentric shaft revolutions. In the example, engine RPM calculation is determined by solving for

[10] This discussion assumes that the Tester is being used with a Mazda rotary engine. For other rotary engines, consult the appropriate workshop manual for engine compression specifications.

"x" in the simple ratio of 9/1.84=x/60, where "x" equals engine cranking RPM at the time of the test. (That is, 1.84x=9*60; therefore x=540/1.84 or 293.)

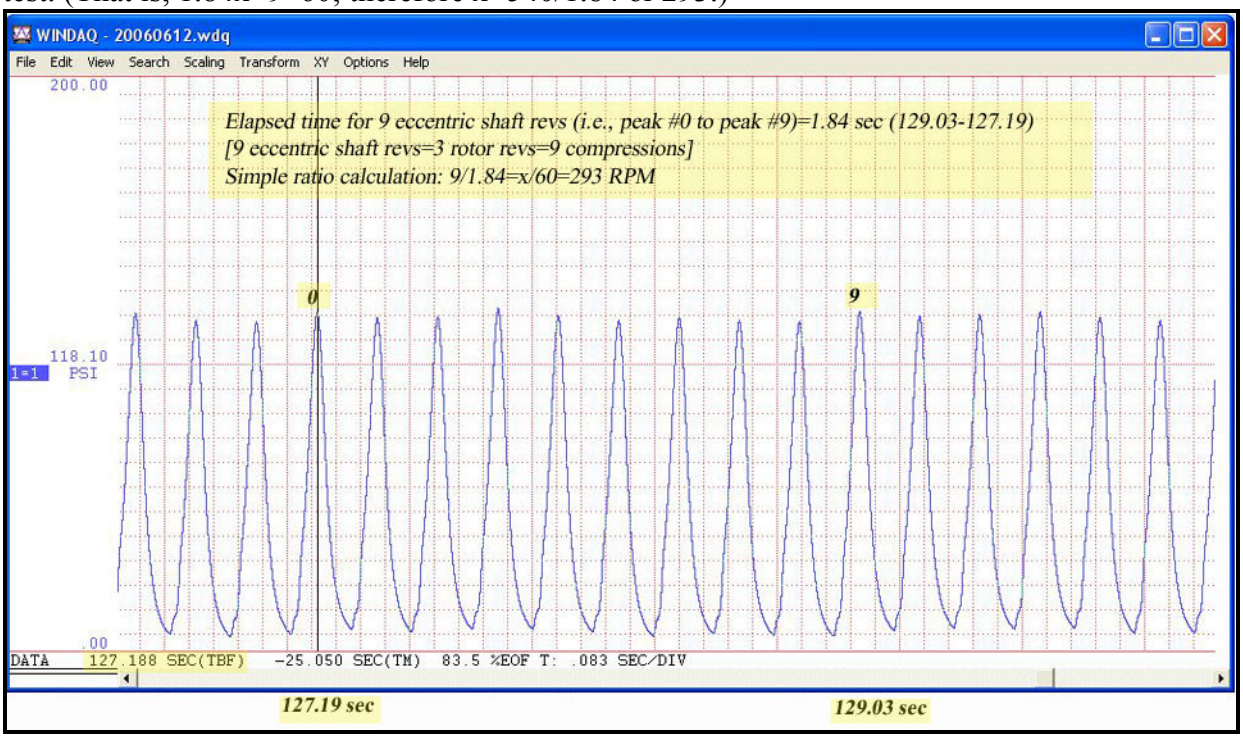


***Figure 17. Example of engine cranking RPM calculation.***

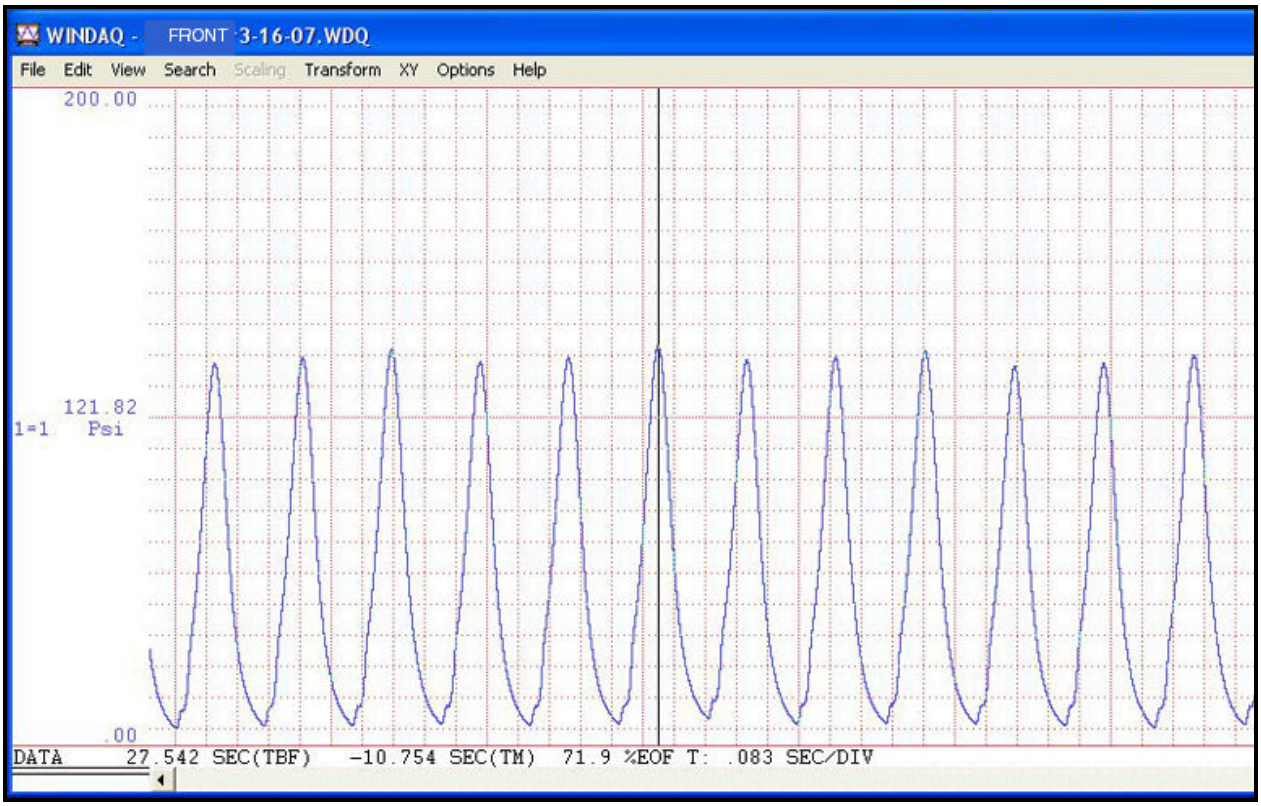


***Figure 18. Indication of healthy engine, front rotor readings from 3rd generation RX-7.***

If any rotor faces are well below the Mazda minimum standard, your engine probably requires rebuilding or replacement. The example below (Figure 19) was recorded from the same 3rd generation RX-7 engine as the above example, but as you can see, compression readings for two of the rear rotor faces are significantly lower than the third face and well below the Mazda minimum. This is definitely an indication of seal failure and the engine will need to be rebuilt or replaced. Obviously, if any of the recorded readings are at or near zero, your engine is definitely sick and will need to be rebuilt or replaced. For questionable compression readings, it is advisable to run additional tests to verify the numbers and to verify that you prepared the tester system correctly for a test with questionable results.

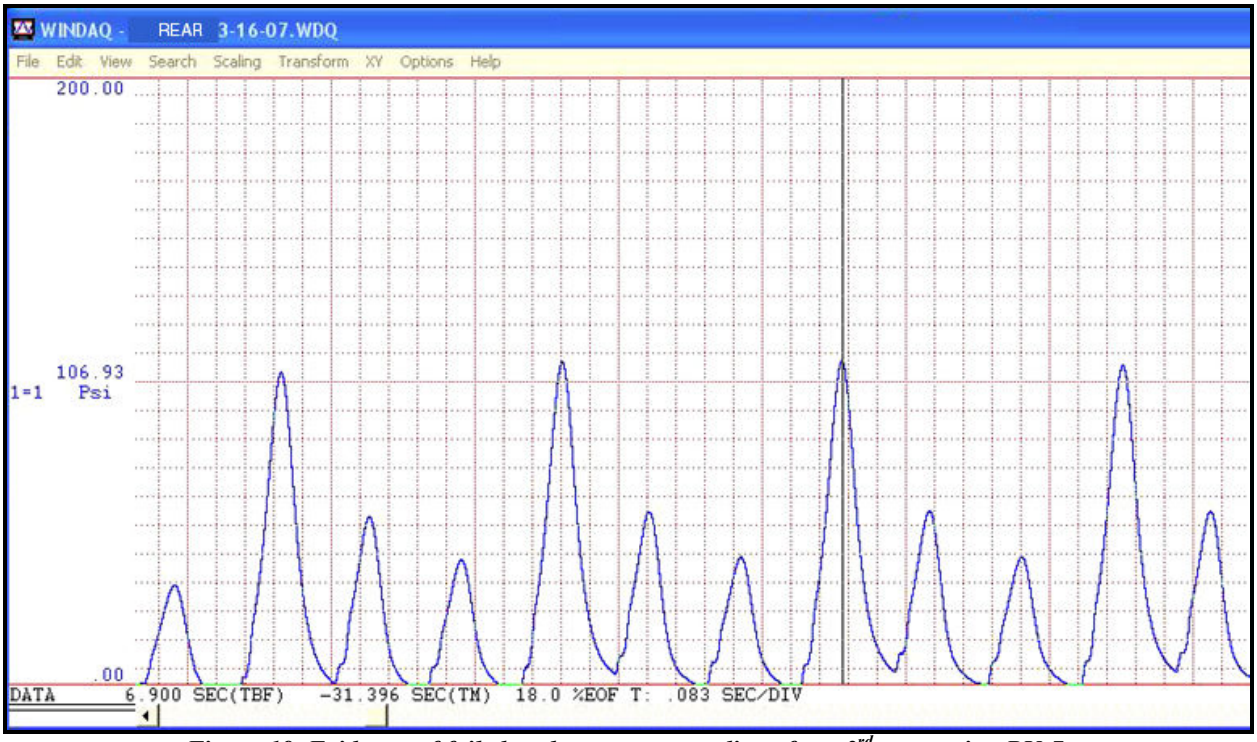


***Figure 19. Evidence of failed seal, rear rotor readings from 3rd generation RX-7.***

In the shop manual for the second generation RX-7, Mazda states the compression specifications for the 13B engine at sea level with engine cranking speed of 250 RPM. The minimum compression for this engine is given as 85 PSI. So, in general, compression higher than that should indicate a relatively healthy engine. Mazda also indicates that the maximum difference between the rotor faces should be no more than 21 PSI.

The workshop manual for the RX-8 states the "standard" compression as 120 PSI at 250 RPM, and the minimum as 98.6 PSI at 250 RPM. Standard difference in chambers should be within 21.8 PSI, and difference between rotors within 14.5 PSI.

Readings outside of those levels, i.e., lower compression readings or greater difference in readings between rotor faces or between rotors, indicates a less-than-healthy engine that may require rebuilding or replacement in the near future.

Consult the appropriate workshop manual for compression specifications for other rotary engines.

## *Troubleshooting*

**Problem**: When I connect the power cord to the battery, the green LED power-on indicator does not light and the system does not function.

**Answer**: Double check the battery clip attachments and make sure the red clip is attached to the positive/plus pole of the battery and the black clip is attached to the negative/minus pole. If the connections seem to be in order, disconnect the battery clips and remove the enclosure cover. Check to see if the 1A fuse is blown. If it is, replace it with a comparable fuse and see if the system now powers up. If the fuse is not blown or if you replaced it and the system still does not power up, try connecting the system to another, known-good, 12VDC battery. If none of that solves the problem, contact the RDS for assistance.

**Problem**: When I run the test, nothing is recorded by the Hardware Manager.

**Answer**: First, carefully scan through the entire data record using the WinDaq® Waveform Browser to verify that nothing was recorded. Remember, if the recording ran for say 60 seconds, a 5-second burst of compression pulses may be difficult to locate in the data stream. So, scan the data to verify that the compression data is, in fact, not there. If it is definitely not there, then go through a full test setup as follows:

Shut down the Hardware Manager program, disconnect all cables and basically start over. Plug the USB cable into the DATAQ port on the side of the enclosure and launch the Hardware Manager program. Run through the instructions in the section entitled *Hardware Manager Configuration* to verify that the program is configured correctly. [Note: the USB cable must be connected to the DATAQ port and to the computer before launching the Hardware Manager program.]

If still no data is recorded, contact the RDS for further instructions.

**Problem**: The test seems to run OK, but the data shows what look like irregularly-spaced compression pulses.

**Answer**: Compare your recording to the sample record in Figure 18. As you can see in the sample, the compression pulses are very regularly spaced and similar in amplitude. If your recorded data shows what would be gaps where a pulse or pulses should be shown, this is probably due to lack of compression on one or more rotor faces—most likely the result of one or more failed/failing seals. If you like, you can e-mail a copy of the ***.wdq*** file to RDS for evaluation.

**Problem:** I ran the test but the data is difficult to "read" because the pulses are too close together.

**Answer:** The sample rate during the test may have been inadvertently set too low. Either re-run the test at 240 samples/second (see page 9) or set the data display compression as instructed at the top of page 15. Re-running the test at the higher sampling rate will result in a "smoother" display of the data if it had been run at a slower sample rate.

**Problem**: My recorded readings show compression pulses with differences in amplitude. What does that indicate?

**Answer**: In order to answer that question, you must first extract and compare the readings from all rotor faces. Then consult the appropriate workshop manual to determine the engine compression specifications for your particular engine to see if the readings fall within the manufacturers limits for a healthy engine. In general, however, if the differences in the compression readings between rotor faces and/or between rotors are significant, your engine is less than healthy. And depending on the specific compression numbers, your engine may require rebuilding or replacement.

**Problem**: When I launch the Hardware Manager program, the DATAQ device is recognized, but when I click on *Start WinDaq*® I get an error message.

**Answer**: Occasionally, internal program component linkages are "lost" or the installation of a program or security fix after installation of the DATAQ software will modify a required component of the program. Try rebooting the computer and if that doesn't eliminate the error, reinstall and configure the DATAQ software. Also, if you disconnected the USB cable after starting the Hardware Manager program, the program will almost certainly freeze or show an error message. If this is the problem, reboot the computer and restart Hardware Manager. Otherwise, uninstall the WinDaq® programs, reboot the computer and reinstall the latest version of the software. A link to the latest software can be found at the bottom of the following page on our web site: http://www.rotarydiagnostics.com/pricing%20combined.htm.

NOTE: Rotary Diagnostics Systems has made a good-faith effort to build and deliver a working test device that will provide accurate compression measurements for many years. However, we strive constantly to improve our products, so your constructive criticisms and your suggestions will be greatly appreciated. Do not hesitate to contact the RDS if you have problems with the system or if you would like to pass on any comments.

## *Contact Information*

For assistance or questions, contact Larry at:

Rotary Diagnostics Systems
P.O. Box 524
Mont Alto, PA 17237 USA
(717) 352-7096 (In case no one answers, leave a message and you will be contacted ASAP.)
(717) 360-3633 (cell)
Rotary13b@RotaryDiagnostics.com
http://RotaryDiagnostics.com

## *Warranty*

The Tester is warranted for a period of one year from the date of purchase. This warranty is limited to repair or replacement of any components necessary to restore the system to full functionality. Rotary Diagnostics Systems (RDS) will restore the system to full functionality at no cost to the customer unless the malfunction is the result of improper use or abuse of the Tester. In rare cases, the Tester may be replaced with a new system at the option of RDS. Contact RDS for instructions on returning a system for service or for a warranty claim.

Safe and effective operation of each unit is verified prior to sale. Any modifications to this system by anyone other than RDS totally voids the stated warranty. The customer is authorized to remove the enclosure cover to check and/or replace the fuse if necessary. No other servicing of, or modifications to, the Tester by the customer are authorized.

Beyond the stated warranty, RDS is not liable for any system failures due to improper or abusive use of the system. For example, reversing battery connections resulting in component damage constitutes an improper use of the Tester. Nor is RDS responsible for resultant damage to an engine or engine component due to misuse of the Tester system.

CAUTIONS: Do not attempt to disassemble the spark plug hole adapter (item 3, Figure 1). The threads are sealed with an epoxy and any attempt to separate the components will almost certainly render this component inoperable, requiring replacement at the owners' expense.

In addition, the pressure transducer (Item 2, Figure 1) in this system is a precision instrument and should be handled accordingly. While the unit is not fragile, **extreme** mishandling, especially involving high lateral G forces or excessive stress on the cable, may damage the internal elements and render it inoperable. The pressure transducer is not user-serviceable, and attempts to disassemble or modify it in any way will likely result in an inoperable system and will definitely void the warranty.

NOTICE: Customer service requests, particularly those that potentially involve component warranty claims, must be handled through RDS. Do not contact component manufacturers directly without first contacting RDS for assistance. Support services and warranties on individual system components fall to the original component purchaser--namely Rotary Diagnostics Systems. For further guidance, contact RDS.

## *Appendix A: Tester System software installation.*

The following instructions are for installing the hardware drivers and programs on computers running Windows operating systems.

Power up your computer and allow it to fully boot up. Do not connect the main enclosure to your computer at this time. Insert the WinDaq® Resource Disk into your CD/DVD drive. The WinDaq® install program should launch automatically and bring up the first install process window. Follow the instruction in each succeeding window. When asked if you want to install WinDaq/XL, select "No Thanks". WinDaq/XL is an add-on program which requires an additional purchase and it is not required for this application. If the program does not launch automatically, navigate to your CD/DVD drive and double-click on the ***exe*** file to launch the program. (The ***exe*** file should be named something similar to ***dataq_starterkits.exe.*** Your Resource Disk may contain a more recent install file by a slightly different name.)

When instructed, connect the enclosure to your computer using the supplied USB cable. Make sure the cable connects securely into the enclosure port and the USB port on your computer. You should hear the "USB connect" tone when the cable is plugged in. You are now ready to configure the Hardware Manager program. Return to page 4 to complete the software configuration. If problems are encountered with the this procedure, try the Alternate Tester System instructions below.

## *Alternate Tester System software installation.*

Go to the latest software download page (http://www.dataq.com/support/installation-instructions.html). Follow the instructions on that page which includes an imbedded link to download the WinDaq software.

Congratulations! You have successfully installed all the software required by the System. You can remove the Resource Disk from the computer drive, but if you plan to complete the Hardware Manager configuration at this time you can leave the System enclosure connected to your computer. Return to page 4 when ready to configure the Hardware Manager program and complete the software installation and configuration process.